

**MONITORING INFESTATION RATES OF THE TOMATO FRUIT WORM,  
*HELICOVERPA ARMIGERA* HUBNER (LEPIDOPTERA: NOCTUIDAE) IN TOMATO  
 FIELDS AT LAKE NASSER REGION, ASWAN, UPPER EGYPT  
 BY**

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**ABSTRACT**

**Monitoring** the population dynamics of the tomato fruit worm, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae) and estimating its rates of infestation in tomato fields at Lake Nasser region, Aswan, Egypt as basic data for pest control programs was carried out. Estimation of the infestation rates using direct counts of the pest larvae and number of moths per pheromone trap was carried out in three sites at Khalabsha district, Aswan Governorate for two successive growing seasons 2004/2005 and 2005/2006. Highest rates of *H. armigera* infestation; 5.9 and 11.8 % were recorded during March and April, respectively. General seasonal means of infestation rate were 4.4 and 5.49 % in seasons; 2004/2005 and 2005/2006, respectively. General seasonal mean number of moths /trap in the three sites was 17.9 and 7.9 moths /trap during the 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively. Statistical analysis showed that there was a positive correlation between the rate of infestation and the number of trap catches in both seasons and the correlation was larger in the second season.

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**Key Words:** *Helicoverpa armigera*, Tomato, Infestation rates, Pheromone traps, Egypt

**INTRODUCTION**

Nasser Lake is located behind the High Dam at Aswan Governorate, Upper Egypt. The lake extends about 500 km, 350 in Egypt plus 150 in Sudan. Tomato is one of the essential vegetable crops in this region. Its cultivated area is about 2014 feddans (18.3 % of the total area), represented mainly by Nile and winter lugs (World Food Program, assisted project Nasser lake report, 2004). Tomato plants are subject to be infested with several insect pests such as; whiteflies, aphids, leaf miners and some lepidopterous pests. The tomato fruit worm, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae), is the major insect pest in the tomato fields in this region (Abbas, 1998).

Talekara *et al.* (2005), Bues *et al.* (2005) and Moral Garcia (2006) reported that

*H. armigera* is a highly polyphagous pest that attacks over 100 plant species including such widely grown and economically important crops as cotton, maize, tobacco, pigeon pea, chickpea and tomato. In the Nile Valley region, *H. armigera* has five generations per year, three generations of them on cotton and two on vegetables. Seasonal infestation with the tomato fruit worm usually lasts from April to September in the valley, while it extends from October to May, according to the lug in Lake Nasser region. Larvae of *H. armigera* may attack tomato crops from transplanting until fruit maturity but the most sensitive growing period coincides with the most attractive phenological stages of ovipositing females, from the beginning to the ending of the flowering stage. The predilection of this moth species for the harvestable fruiting parts, high

polyphagous, wide geographical range, mobility, migratory potential, facultative diapause, high fecundity and propensity to develop resistance to insecticides are the main factors that contribute strongly to its pest status Selvanarayanan and Narayanasamy (2006). Larvae feed on the reproduction parts of the tomato plants such as; buds and flowers (Adashkevich and Rashidov, 1986). Infested fruits commonly contain rounded pits and holes that made by the larvae. The larvae prefer immature fruits at their conjunction part with the plants, where the front body of larva is seen inside the fruit and the back body is outside the fruit. Infestation's appearance on the leaves is similar to that of lepidopterous pests (Brochure of tomato pests in Egypt and IPM methods, 1995).

The single study found on the pest in Lake Nasser region was carried out by Abbas (1998). He reported that the tomato fruit worm, *H. armigera* is the major insect pest infesting tomato in the field at the new reclaimed land around Lake Nasser in Aswan Governorate, Egypt. The larvae bore into the green fruits and cause considerable loss in the yield.

The aim of the study is monitoring the population dynamics of the fruit worm, *H. armigera* and estimating its rates of infestation in tomato fields at Lake Nasser region, Aswan, Egypt as basic data for pest control programs.

## MATERIALS AND METHODS

A quantitative and qualitative estimation of the infestation with the tomato fruit worm, *H. armigera* in the tomato fields was carried out in three sites; (Khor Abdel-Seed, Khor Elsuol and El-Daleel) at Khalabsha district, Aswan Governorate, representing the largest tomato agricultural areas in the region, for two successive growing seasons 2004/2005 and 2005/2006.

Two fields (5 feddans each) at each of the three working sites were chosen, as replicates for the study in the first season, 2004/2005, while only one field /site (one replicate) was used in the second season 2005/2006. In the three experimental sites, planting date was during the 1<sup>st</sup> week of October in both seasons. All areas were cultivated by the tomato variety "Kasel rock", the common and recommended variety in the region. Experimental plots received regular

cultural practices without using pesticides during the two seasons.

In each field, one sex pheromone trap for *H. armigera* moths was placed in the center of the field. Fresh pheromone lures were exchanged every 6 weeks. Direct inspection and count technique was practiced to determine total numbers of fruits and infested ones on 20 random tomato plants /site/date. Consequently, percentages of infestation were calculated. Inspection of both the sex pheromone trap catches of *H. armigera* moths and the natural infestation rates was undertaken biweekly/site/date through the period lasted from September to April 2004/2005 and 2005/2006 growing seasons. Obtained data were recorded and summarized as well were statistically analyzed using ANOVA statistical method.

## RESULTS AND DISCUSSION

### I- Season 2004/2005

#### Direct infestation counts

First infestation record with *H. armigera* larvae was found at Khor Abdel-Seed and El-Daleel fields during the 3<sup>rd</sup> week of November, 2004, about 45-50 days post planting date, this usually coincides with the

beginning of the tomato plant flowering stage. At Khor Elsuol, the third field, it occurred during the next inspection, 2<sup>nd</sup> week of December, 2004. The infestation continued with different rates up to the end of the season (Table 1). As shown in the table, percentages of infestation ranged between 1.4 – 11.0, with

an average of 4.8 %; 0.5-20.1, with an average of 4.2 %, and 2.6-15.9, with an average of 4.7 % at Khor Abdel-Seed, Khor Elsuol and El-Daleel, respectively.

Highest rates of *H. armigera* infestation ranged between 5.6 and 20.1 % were recorded by end of March 2005. General mean of infestation didn't exceed 3.9 % throughout the first four months (November through February). The general mean of infestation rate in the three sites for the whole season was 4.58 % (Fig. 1).

Statistical analysis showed that there were no significant differences in the rate of *H. armigera* larval infestation not only between the two replicates at each site but also among the three different sites.

#### **Pheromone trap catches**

First catch of *H. armigera* moths in the pheromone traps was found during the 3<sup>rd</sup> week of November, 2004. As shown in Table (2), numbers of moths counted in the traps were largely oscillated throughout the season. It was nil for several weeks and of sudden, 30 moths /trap by mid-February, 2005 at Khor Abdel-Seed and 51 moths /trap by mid-March at El-Daleel were recorded. Highest monthly mean numbers of moths /trap (21.2 and 24.6) were recorded during February and March, 2005. These months represent the highest infestation period with *H. armigera* in tomato fields in the region. General mean numbers of moths /trap was very close (19.3 and 19.5) at Khor Abdel-Seed and Khor Elsuol, respectively while it was relatively lower (14.9) at El-Daleel. General seasonal mean number of moths /trap in the three sites was 17.9 (Fig. 2).

Statistical analysis showed that there were significant differences between the two replicates of each of Khor Abdel-Seed and El-Daleel in the number of *H. armigera* moths /trap and among the trap catches at the three different sites but there was no significant difference between the two replicates of Khor Elsuol.

#### **II- Season 2005/2006**

Data of the direct infestation counts as well as the pheromone trap catches were

collected from only one replicate in this season.

#### **Direct infestation counts**

First infestation records with *H. armigera* larvae in the second season occurred late, during the 3<sup>rd</sup> week of December 2005, about 60-65 days post planting date, with relatively high rates of infestation; 12.7 % at Khor Abdel-Seed, 12.1 % at Khor Elsuol and 5.2 % at El-Daleel and continued with these high rates during the 1<sup>st</sup> week of January, 2006 and then decreased towards the end of the season to reach 3.8 – 5.7 % during March and April (Table 3). General seasonal mean of infestation rate was 5.56 %, season 2005/2006 compared with 4.58 %, season 2004/2005 (Fig. 1).

Statistical analysis showed that there were significant differences among the three different sites in the rate of *H. armigera* larval infestation.

#### **Pheromone trap catches**

*H. armigera* moths occurred early in the traps, during the 3<sup>rd</sup> week of November, 2005 (about a month earlier than the first records of larval infestation but at the same time of the first season), with very low numbers (2-3 moths /trap). They continued with these low numbers during the next inspection date, 1<sup>st</sup> week of December, particularly at El-Daleel, and Khor Elsuol but at Khor Abdel-Seed they increased sharply to (46 moths / trap) from 1<sup>st</sup> week of December, 2005 up to 2<sup>nd</sup> week of February, 2006 and then dropped obviously till the end of the season.

Generally, the number of moths /trap in the second season was much less than that of the first season, particularly at El-Daleel, and Khor Elsuol. General means at the two sites ranged between 0.6 and 0.9, while it was 22.2 at Khor Abdel-Seed (Table 4). General seasonal mean of moths' number in the three sites was 7.9 moths /trap in the second season compared with 17.9 moths /trap in the first season (Fig. 2).

Table (1): Percentages of infestation with *Helicoverpa armigera* Hb. in tomato fields at Kalabsha district, Aswan Governorate season, 2004-2005

Date	Khour-Abdelseed		Khour - Elsuol		El -Daleel	
	R1	R2	R3	R4	R5	R6
25/11/2004	4.4	3.3	0.0	0.0	11.1	4.6
12/09/2004	2.7	1.4	2.1	0.5	3.6	4.8
23/12/2004	1.8	4.3	1.5	1.6	0.0	3.1
01/06/2005	2.6	2.3	1.6	1.2	3.8	2.1
20/01/2005	2.9	3.4	0.6	0.3	4.0	4.3
02/03/2005	4.1	3.7	0.8	2.4	2.6	2.5
17/02/2005	5.4	5.4	2.8	3.4	4.6	0.8
03/03/2005	5.7	4.7	4.7	4.4	2.55	2.6
17/03/2005	9.4	9.4	12.5	5.3	7.5	8.5
31/03/2005	5.6	11.0	20.1	9.1	9.1	15.9
<b>Total</b>	<b>45</b>	<b>51</b>	<b>50</b>	<b>35</b>	<b>47</b>	<b>47</b>
<b>Mean</b>	<b>4.5</b>	<b>5.1</b>	<b>5.0</b>	<b>3.5</b>	<b>4.7</b>	<b>4.7</b>

Table (2): Numbers of *Helicoverpa armigera* Hb. moths/pheromone trap in tomato fields at Kalabsha district, Aswan Governorate season, 2004-2005

Date	Khour-Abdelseed		Khour - Elsuol		El -Daleel	
	R1	R2	R3	R4	R5	R6
25/11/2004	16	15	0.0	5	0.0	0.0
12/09/2004	5	10	6	29	54	1
23/12/2004	1	31	0.0	32	34	1
01/06/2005	0.0	18	0.0	63	83	0.0
20/01/2005	0.0	7	0.0	5	18	0.0
02/03/2005	0.0	45	0.0	24	19	0.0
17/02/2005	0.0	23	30	43	70	0.0
03/03/2005	0.0	71	18	6	5	1
17/03/2005	51	51	46	46	0.0	0.0
31/03/2005	0.0	42	28	8	12	0.0
<b>Total</b>	<b>73</b>	<b>313</b>	<b>128</b>	<b>261</b>	<b>295</b>	<b>3</b>
<b>Mean</b>	<b>7.3</b>	<b>31.3</b>	<b>12.8</b>	<b>26.1</b>	<b>29.5</b>	<b>0.3</b>

F value = 1.73\*

L.S.D. = 16.607

Table (3): Percentages of infestation with *Helicoverpa armigera* Hb. in tomato fields at Kalabsha district, Aswan Governorate season, 2005-2006.

Date	Khour-Abdelseed	Khour-Elsuol	El-Daleel
23/11/2005	0.0	0	0.0
12/07/2005	0.0	0	0.0
21/12/2005	12.7	12.1	5.2
07/01/2006	10.9	12.5	6.0
24/1/2006	9.2	8.8	4.1
08/02/2006	7.3	8.5	5.2
22/2/2006	5.9	8.6	5.7
08/03/2006	5.7	5.3	5.1
23/3/2006	4.3	4.8	5.6
08/04/2006	3.8	4.6	4.7
<b>Total</b>	<b>59.8</b>	<b>65</b>	<b>42</b>
<b>Mean</b>	<b>6</b>	<b>6.5</b>	<b>4.2</b>

Table (4): Numbers of *Helicoverpa armigera* Hb. moths/pheromone trap in tomato fields at Kalabsha district, Aswan Governorate season, 2005-2006

Date	Khour-Abdelseed	Khour-Elsuol	El-Daleel
23/11/2005	3	0	2
12/07/2005	46	0	0
21/12/2005	48	0	7
07/01/2006	44	0	0
24/1/2006	35	2	0
08/02/2006	46	1	0
22/2/2006	0	3	0
08/03/2006	0	0	0
23/3/2006	0	0	0
08/04/2006	0	0	0
Total	222	6	9
Mean	22.2	0.6	0.9

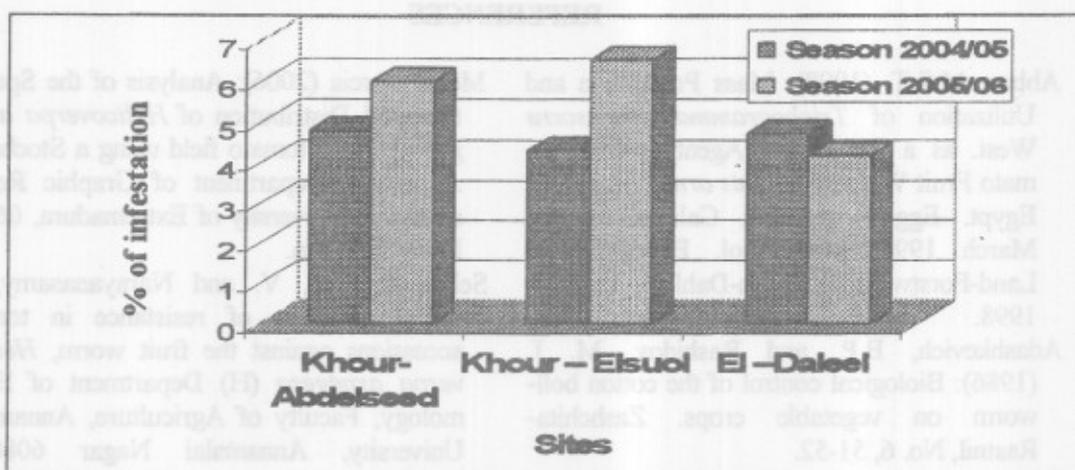


Fig. (1): Seasonal mean percentages of infestation with *Helicoverpa armigera* Hb. in tomato fields at three working sites in Kalabsha district, Aswan Governorate seasons 2004-2005 and 2005-2006.

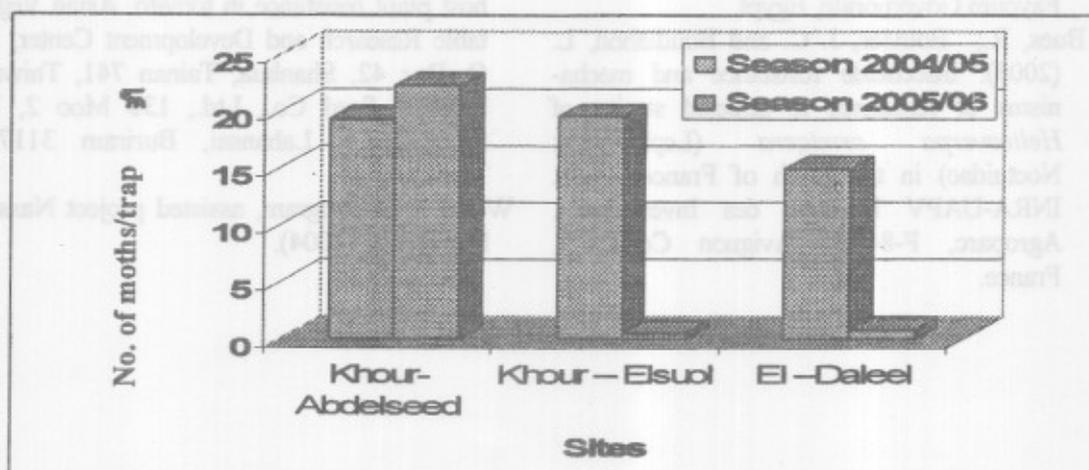


Fig. (2): Seasonal mean numbers of *Helicoverpa armigera* Hb. Moths/pheromone trap in tomato fields at three working sites in Kalabsha district, Aswan Governorate seasons 2004-2005 and 2005-2006.

Statistical analysis showed that there were significant differences in the number of *H. armigera* moths /traps between the two seasons at El-Daleel and Khor Elsuol, while there was no significant difference between the two seasons at Khor Abdel-Seed.

Statistical analysis showed also that there were positive correlations between the rate of infestation and the number of trap catches in both seasons. The correlation was larger in the second season;  $r = 0.0893$  ( $Y = 0.1105 X + 2.3948$ ) in season 2004/2005 and  $r = 0.01612$  ( $Y = 0.1758 X + 4.1009$ ) in season 2005/2006.

As concluded, the rate of *H. armigera*'s infestation in the tomato fields at Kalabsha district, Aswan Governorate had increased by the end of the season (March and April), the most serious infestation period of the pest in the region, but its seasonal general mean percentage didn't exceed 6.5% in the two seasons. Although the statistical analysis had showed positive correlation between the rate of infestation and the numbers of trap catches in both seasons, the numbers of moths counted in the traps were largely oscillated throughout the season, therefore, it cannot be considered an accurate method for monitoring the pest population in the field.

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متابعة معدلات الإصابة بدودة ثمار الطماطم *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae) في حقول الطماطم بمنطقة بحيرة ناصر، أسوان، مصر

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تم متابعة ديناميكية تعداد دودة ثمار الطماطم *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae) وتقدير معدلات الإصابة في حقول الطماطم بمنطقة بحيرة ناصر، أسوان، مصر كقاعدة بيانات لبرامج مكافحة الآفة في المنطقة. تم تقدير معدلات الإصابة باستخدام العد المباشر ليرقات الآفة على النبات وعد أعداد الفراشات في المصائد الفرمونية في ثلاث مواقع بمنطقة كلابشة، محافظة أسوان على مدى موسمي نمو متتاليين ٢٠٠٤/٢٠٠٥ & ٢٠٠٥/٢٠٠٦. سجل أعلى تعداد للإصابة بالآفة ٥,٩ & ١١,٨% خلال شهري مارس وأبريل، على التوالي. بلغ المتوسط العام الموسمي لنسبة الإصابة ٤,٤ & ٥,٤٩% في موسمي ٢٠٠٤/٢٠٠٥ & ٢٠٠٥/٢٠٠٦، على التوالي. بلغ المتوسط العام الموسمي لأعداد الفراشات في المصائد في الثلاث مواقع ١٧,٩ & ٧,٩% فراشة / مصيدة خلال الموسم الأول والثاني، على التوالي. أظهر التحليل الإحصائي وجود علاقة إيجابية بين معدل الإصابة وعدد الفراشات في المصيدة في الموسمين، وكان معامل الارتباط أكبر في الموسم الثاني.

كلمات مفتاحية: *Helicoverpa armigera* ، الطماطم، معدل الإصابة، المصائد الفرمونية، مصر.